U.S. Patent No. 5,296,726 to MacElwee. Claims 8, 9, 22 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of U.S. Patent No. 6,372,585 to Yu. Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of U.S. Patent No. 5,708,284 to Onishi. Claim 1 was rejected under the judicially created doctrine of double patenting over claim 1 of U.S. Patent No. 6,369,409 to Takasu et al. ("Takasu"). Additional art was cited of interest.

In accordance with the present response, original independent claim 1 has been amended to incorporate the subject matter of claims 5-9 and to further patentably distinguish from the prior art of record. Original claims 1-4, 10-20 and 24-31 have also been amended in formal respects to improve the wording thereof. Claims 5-9 and 21-23 have been canceled. Non-elected claims 32-33 have been canceled without prejudice or admission and subject to applicants' right to file a continuing application to pursue the subject matter of the non-elected claims. A new, more descriptive abstract has been substituted for the original abstract.

Attached hereto is a marked-up version of the changes made to the abstract and claims by the current amendment. The attached pages i-vii are captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

Applicants respectfully request reconsideration of their application in light of the following discussion.

The present invention is directed to a semiconductor device.

In conventional bleeder resistance circuits using thin film resistors, there is a problem that a voltage division ratio becomes inaccurate frequently. Furthermore, in a conventional bleeder resistance circuit coordinating a MOS transistor in the same chip, there has been such a problem that a resistance value change due to the temperature of polysilicon thin film resistors is large in a region of high sheet resistance value, and the sheet resistance value has to be set small in order to obtain high voltage division accuracy in a wide temperature range. As a result, the area occupied by the bleeder circuit region requiring a high resistance value at one meg-ohm or higher becomes larger.

The present invention overcomes the drawbacks of the conventional art. Fig. 1 shows an embodiment of the semiconductor device according to the present invention embodied in the claims. The semiconductor device has thin film resistors 105-107 connected in series to form a bleeder resistance circuit. Each of the thin film resistors 105-107 is made of a polysilicon film doped with B or $BF_2$ P-type impurities and has two end portions each having a high impurity concentration region ($P^+$ region). A first insulating film 102 overlies the thin film resistors 105-107. First conductors 201-204 are connected to the ends of the thin film

resistors 105-107 for connecting the thin film resistors in series. There are also second conductors 301-303 each connected to a respective one of the first conductors 201-204 and overlying a respective one of the thin film resistors 105-107 through the first insulating film 102.

By the foregoing construction, a semiconductor device is provided which has a bleeder resistance circuit of high accuracy and having an accurate voltage division ratio and a small temperature coefficient of a resistance value.

The prior art of record does not disclose or suggest the subject matter recited in amended claims 1-4, 10-20 and 24-31 and newly added claims 34-36.

**Traversal of Prior Art Rejections**

Claims 1-4, 10-15, 17-20 and 24-31 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,296,726 to MacElwee. Applicants respectfully traverse this rejection and submit that the teachings of MacElwee do not disclose or suggest the subject matter recited in amended claims 1-4, 10-15, 17-20 and 24-31.

Amended independent claim 1 is directed to a semiconductor device and requires a plurality of thin film resistors connected in series to form a bleeder resistance circuit, each of the thin film resistors being made of a polysilicon film doped with B or $BF_2$ P-type impurities and

having two end portions each having a high impurity concentration region. Amended claim 1 further requires a first insulating film overlying the thin film resistors, a plurality of first conductors connected to the ends of the thin film resistors for connecting the thin film resistors in series, and a plurality of second conductors each connected to a respective one of the first conductors and overlying a respective one of the thin film resistors through the first insulating film. No corresponding structural combination is disclosed or suggested by the prior art of record.

MacElwee discloses a resistive load structure having two thin film accumulation mode field effect transistors connected in series with a common node and separate gate electrodes. MacElwee clearly does not disclose or suggest the structure of the semiconductor device recited in amended independent claim 1, including the recited structural relationship among the thin film resistors, first insulating film and first and second conductors. Furthermore, MacElwee clearly does not disclose or suggest a plurality of thin film resistors each being made of a polysilicon film doped with B or $BF_2$ P-type impurities and having two end portions each having a high impurity concentration region, as required by amended independent claim 1.

Claims 2-4, 10-15, 17-20 and 24-31 depend on and contain all of the limitations of amended independent claim 1 and, therefore, distinguish from the references at least in the same manner as claim 1.

In view of the foregoing, applicants respectfully request that the rejection of claims 1-4, 10-15, 17-20 and 24-31 under 35 U.S.C. §103(a) as being unpatentable over MacElwee be withdrawn.

Original claims 8, 9, 22 and 23, now the subject matter of amended independent claim 1, were rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Yu. Applicants respectfully traverse this rejection and submit that the combined teachings of MacElwee and Yu do not disclose or suggest the subject matter recited in original claims 8, 9, 22 and 23, now the subject matter of amended independent claim 1.

MacElwee does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection of claims 1-4, 10-15, 17-20 and 24-31 under 35 U.S.C. §103(a).

The secondary reference to Yu has been cited by the Examiner for its disclosure of a semiconductor device having a polysilicon layer implanted with boron or $BF_2$. However, Yu clearly does not disclose or suggest the structure of the semiconductor device recited in amended independent claim 1,

including the recited structural relationship among the thin film resistors, first insulating film and first and second conductors. Since Yu does not disclose or suggest these features, it does not cure the deficiencies of MacElwee. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 8-9 and 22-23, now the subject matter of amended independent claim 1, under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Yu be withdrawn.

Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Onishi. Applicants respectfully traverse this rejection and submit that the combined teachings of MacElwee and Onishi do not disclose or suggest the subject matter recited in claim 16.

MacElwee does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection of claims 1-4, 10-15, 17-20 and 24-31 under 35 U.S.C. §103(a). Claim 16 depends on and contains all of the limitations of amended independent claim 1 and, therefore, distinguishes from the reference at least in the same manner as claim 1.

The secondary reference to Onishi was cited by the Examiner for its disclosure of a memory device containing a conductor layer formed of a lamination layer containing a barrier metal and a silicide layer. However, Onishi clearly does not disclose or suggest the structure of the semiconductor device recited in amended independent claim 1, including the recited structural relationship among the thin film resistors, first insulating film and first and second conductors. Since Onishi does not disclose or suggest these features, it does not cure the deficiencies of MacElwee. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 16 under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Onishi be withdrawn.

Claim 1 was rejected under the judicially created doctrine of double patenting over claim 1 of Takasu. Applicants respectfully submit that amended claim 1 is patentably distinct from claim 1 of Takasu.

Amended independent claim 1 requires a plurality of thin film resistors connected in series to form a bleeder resistance circuit, each of the thin film resistors being made

of a polysilicon film doped with B or $BF_2$ P-type impurities. While reciting a plurality of polysilicon thin film resistors, claim 1 of Takasu does not recite that each of the thin film resistors is made of a polysilicon film doped with B or $BF_2$ P-type impurities, as required by amended independent claim 1. Accordingly, amended independent claim 1 patentably distinguish from claim 1 of Takasu.

In view of the foregoing, applicants respectfully request that the rejection of claim 1 under the judicially created doctrine of double patenting over claim 1 of Takasu be withdrawn.

For the reasons noted above, applicants respectfully submit that newly added claims 34-36 also patentably distinguish from the prior art of record.

In view of the foregoing amendments and discussion, the application is now believed to be in condition for

allowance. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner of Patents & Trademarks, Washington, D.C. 20231 on the date indicated below.

Bruce L. Adams
Attorney Name

Signature

OCTOBER 8, 2002
Date

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE ABSTRACT:**

The original abstract has been replaced with the following new abstract:

A semiconductor device has thin film resistors connected in series to form a bleeder resistance circuit. Each of the thin film resistors is made of a polysilicon film doped with B or $BF_2$ P-type impurities and has two end portions each having a high impurity concentration region. A first insulating film overlies the thin film resistors. First conductors are connected to the ends of the thin film resistors for connecting the thin film resistors in series. The semiconductor device has second conductors each connected to a respective one of the first conductors and overlying a respective one of the thin film resistors through the first insulating film.

**IN THE CLAIMS:**

Claims 1-4, 10-20 and 24-31 have been amended as follows:

1. (Amended) A semiconductor device comprising: [a bleeder resistance circuit having] a plurality of thin film resistors connected in series to form a bleeder resistance

circuit, each of the thin film resistors being made of a polysilicon film doped with B or $BF_2$ P-type impurities and having two end portions each having a high impurity concentration region; [are on a first conductor through] a first insulating film overlying the thin film resistors; a plurality of first conductors connected to the ends of the thin film resistors for connecting the thin film resistors in series; and a plurality of second conductors each connected to a respective one of the first conductors and overlying a respective one of the thin film resistors through the first insulating film.

[and the first conductor under the thin film resistors and the thin film resistors are made to have substantially the same potential.]

2. (Amended) A semiconductor device according to claim 1[, wherein]; further comprising a second insulating film [is formed on] overlying the thin film resistors[, a]; wherein the second conductors are [second conductor is] formed on the second insulating film in a position over the thin film resistors[, and] so that the thin film resistors [and the second conductor are made to have substantially] are at the same potential as the second conductors.

3. (Amended) A semiconductor device according to claim 1[,]; wherein each of the first conductors is at [conductor

corresponding to each of the plurality of thin film resistors has substantially] the same potential as a respective one of the [each of the plurality of] thin film resistors.

4. (Amended) A semiconductor device according to claim 2[,]; wherein each of the second conductors is at [conductor corresponding to each of the plurality of thin film resistors has substantially] the same potential as a respective one of the [each of the plurality of] thin film resistors.

10. (Amended) A semiconductor device according to claim 1; [5 or 6,] wherein [a] the film thickness of each of the thin film resistors is several tens to 2000 angstroms.

11. (Amended) A semiconductor device according to claim [5 or 6,] 1; wherein [a] the film thickness of each of the thin film resistors is several tens to 1000 angstroms.

12. (Amended) A semiconductor device according to claim [5 or 6,] 1; wherein the first conductors are composed of well regions [conductor is made from a well region] formed in a silicon substrate.

13. (Amended) A semiconductor device to claim 1; [5 or 6,] wherein the first conductors are [conductor is] made of polysilicon.

14. (Amended) A semiconductor device according to claim [6,] 1; wherein the second conductors are [conductor is] made of polysilicon.

15. (Amended) A semiconductor device according to claim [6,] 1; wherein the second conductors are [conductor is] made of aluminum.

16. (Amended) A semiconductor device according to claim [6,] 1; wherein the second conductors are [conductor is] made from a lamination film of a barrier metal and a silicide film.

17. (Amended) A semiconductor device according to claim 1; [6,] wherein the first conductors are [conductor is] made of a material [constituting] forming a gate electrode of [an] a MOS [type] transistor formed on the same chip as [which is formed together with] the plurality of thin film resistors [on a single chip].

18. (Amended) A semiconductor device according to claim 1; [5 or 6,] wherein potentials [the potential] of each of the plurality of thin film resistors and the [potential of the] first conductors connected [conductor corresponding] to them [each of the thin film resistors] are fixed by a metal wiring material through a common contact hole.

19. (Amended) A semiconductor device according to claim 1; further comprising a [claims 5 and 6, wherein, in the semiconductor device which has a bleeder resistance circuit using the plurality of thin film resistors and at least one] MOS [type] transistor[,] having a gate electrode; and wherein a film thickness of each of the thin film resistors [of the bleeder resistance circuit] is formed thinner than a film thickness [that] of [a] the gate electrode of the MOS [type] transistor.

20. (Amended) A semiconductor device according to claim 19[,]; wherein the film thickness of the thin film resistors is several tens to 1000 angstroms.

24. (Amended) A semiconductor device according to claim 19[,]; wherein a temperature dependency of [a] the resistance value of the thin film resistors is -4000 ppm/°C or [less] lower.

25. (Amended) A semiconductor device according to claim [5 or 6, wherein, in the semiconductor device having the thin film resistors,]1; wherein each of the thin film resistors has [are made from] a low resistance region [which is connected] having the high impurity concentration for connecting with [a] metal wiring, and [has a high impurity concentration and] a

high resistance region[,]; and wherein a film thickness of the high resistance region is smaller than that of the low resistance region.

26. (Amended) A semiconductor device according to claim 25[,]; wherein the film thickness of the high resistance region is several tens to 1000 angstroms and the film thickness of the low resistance region is 2000 to 10000 angstroms.

27. (Amended) A semiconductor device according to claim 25[,]; wherein the low resistance region and the high resistance region of the thin film resistors are formed on [the same] a common flat surface.

28. (Amended) A semiconductor device according to claim 25[,]; wherein [the] upper surfaces [surface] of the low resistance region and the high resistance region of the thin film resistors [forms] form the same flat surface.

29. (Amended) A semiconductor device according to claim [5 or 6,]2; wherein the first insulating film and the second insulating film are made of a silicon oxide films [film].

30. (Amended) A semiconductor device according to claim [5 or 6,]2; wherein one or both [at least one] of the first insulating film and the second insulating film are made of a multilayer film containing [including] a silicon nitride film.

31. (Amended) A semiconductor device according to claim [5 or 6,]1; wherein a resistance value of the entire bleeder resistance circuit using the plurality of thin film resistors is 1 mega-ohm [megaohm] to 100 mega-ohms [megaohms].